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A REVIEW OF D. L. CRAWFORD'S SPECIES OF THYSANOPTERA

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As a part of a study of California thrips it has been necessary to carefully review all the previous work done in order to accurately identify valid species and to avoid creating additional synonymy when describing new forms. In former papers the writer has reviewed other published works on western Thysanoptera. The present report covers the species described by D. L. Crawford[1].

The two genera, the sixteen species, and five varieties described by Crawford are listed below in the order they appeared and under the names assigned them. *Ankothrips* n. gen., *A. robustus*, *Aeolothrips longiceps*, *Euthrips minutus* var. *setosus*, *Phyllothrips fasciculata*, *P. fasciculata* var. *stenoceps*, *Aeolothrips vespiformis*, *Heterothrips decacornis*, *Chirothrips mexicana*, *Euthrips insularis* var. *reticulata*, *Rhaptothrips* n. gen., *R. peculiaris*, *Anaphothrips longipennis*, *Euthrips cephalicus*, *E. cephalicus* var. *reticulata*, *Dictyothrips reticulata*, *Thrips abdominalis*, *Phloeothrips raptor*, *Liothrips umbripennis mexicana*, *Liothrips bakeri*, *Liothrips mcconnelli*, *Anthrothrips variablis*, *Idolothrips angusticeps*.

Hood has studied types and cotypes and reported (*in litt.*) upon the following species: *Phyllothrips fasciculatus*, *P. fasciculatus* var. *stenoceps*, *Chirothrips mexicanus*, *Euthrips insularis* var. *reticulata*, *E. cephalicus*, *E. cephalicus* var. *reticulata*, *Liothrips bakeri*, *L. mcconnelli* and *Anthothrips variabilis*. The synonymy of these species is briefly given below:

[1] Crawford, D. L., 1909, Some new Thysanoptera from Southern California, Pomona Coll. Jour. Ent., 1(4):100-108; Some Thysanoptera of Mexico and the South, ibid., 1(4):109-119; Notes on California Thysanoptera, ibid., 1(4):120-121, 1910, Thysanoptera of Southern California, ibid., 2(1):149-152; Thysanoptera of Mexico and the South, ibid., 2(1):153-170.

HAPLOTHRIPS FASCICULATUS (D. L. CRAWFORD)

1909. *Phyllothrips fasciculata* D. L. Crawford, Pomona Coll. Jour. Ent. 1(4):105-108, fig. 48, A-H.
1909. *Phyllothrips fasciculata* var. *stenoceps, idem,* p. 108.

The complete synonymy has been given by Hood (Pan-Pac. Ent. 3:174-175, 1927) and by Bailey (Pan-Pac. Ent. 13:90, 1937).

CHIROTHRIPS MEXICANUS D. L. CRAWFORD

1907. *Chirothrips crassus* Hooker (nec Hinds), U.S.D.A. Bur. Ent., Bull. 65:13.
1909. *Chirothrips mexicana* D. L. Crawford, Pomona Coll. Jour. Ent., 1:114-115, fig. 51, A-H.
1920. *Chirothrips floridensis* Watson, Fla. Ent. 4(2):21-22.
1923. *Chirothrips floridensis* var. *catchingsi* Watson, Fla. Agr. Exp. Sta. Bull. 168-76.
1927. *Chirothrips mexicanus,* Hood, Ent. News 38:112.
1928. *Chirothrips mexicanus,* Moulton, Proc. Haw. Ent. Soc. 7: 106-107.
1939. *Chirothrips mexicanus,* Andre, Proc. Ent. Soc. Wash. 41(6): 197.
1939. *Chirothrips mexicanus,* Hood, Rev. de Entom. 10(2):464-466 (Brazil).

FRANKLINIELLA INSULARIS (FRANKLIN)

1908. *Euthrips insularis* Franklin, Proc. U. S. Nat. Mus. 33:715, Pl. 63, figs. 1, 2, 3, 5, 6, 7, and Pl. 65, figs. 19, 24.
1909. *Euthrips insularis* var. *reticulata* D. L. Crawford, Pomona Coll. Jour. Ent. 1:116.
1914. *Frankliniella insularis,* Hood, Proc. Ent. Soc. Wash. 16:38.

FRANKLINIELLA CEPHALICA (D. L. CRAWFORD)

1910. *Euthrips cephalicus* D. L. Crawford, Pomona Coll. Jour. Ent. 2:153-155, fig. 63, A-H.
1910. *Euthrips cephalicus* var. *reticulata* D. L. Crawford, Pomona Coll. Jour. Ent., 2:155.
1913. *Euthrips tritici* var. *bispinosus* Morgan, Proc. U. S. Nat. Mus., 46(2008):10-11, figs. 17-18.
1914. *Frankliniella cephalica,* Hood, Proc. Ent. Soc., Wash., 16: 38, 42.
1915. *Euthrips tritici* var. *projectus* Watson, Ent. News 26:51-52.
1919. *Frankliniella bispinosus* Watson, Fla. Buggist 3(1):4-7.
1923. *Frankliniella tritici bispinosa,* Watson, Fla. Ent. 7(1):9-11.
1923. *Frankliniella tritici bispinosa,* Watson, Fla. Agr. Exp. Sta. Bull. 168:39.
1925. *Frankliniella cephalica,* Hood, Bull. Brooklyn Ent. Soc. 20: 72-73.

GYNAIKOTHRIPS UZELI (ZIMMERMAN)

1900. *Mesothrips uzeli* Zimmerman, Bull. Inst. Bot. Buitenzorg, 7:12, fig. 4, i-iv, fig. 5, i, ii.
1908. *Phlaeothrips ficorum* Marchal, Bull. Soc. Ent. France, 14: 252.
1910. *Liothrips bakeri* D. L. Crawford, Pomona Coll. Jour. Ent., 2(1):161-163, fig. 67, A-D.
1913. *Gynaikothrips uzeli*, Hood, Ins. Ins. Mens. 1(12):153-154, Complete synonymy.

LEPTOTHRIPS MALI (FITCH)

1855. *Phlaeothrips mali* Fitch, Trans. N. Y. State Agr. Soc. 14: 806-808.
1902. *Cryptothrips aspersus* Hinds, Proc. U. S. Nat. Mus. 26:205-206, 209.
1904. *Criptothrips californicus* Daniel, Ent. News. 15:293-294.
1908. *Phyllothrips aspersus*, Hood, Canad. Ent. 40:305.
1909. *Leptothrips aspersus*, Hood, Ent. News 20:249-250.
1910. *Liothrips mcconnelli* D. L. Crawford, Pomona Coll. Jour. Ent. 2:163-166, fig. 68, A-G.

The complete synonymy is given by the writer (Bailey, 1940, Jour. Econ. Ent. 33(3):543.

HAPLOTHRIPS GOWDEYI (FRANKLIN)

1908. *Anthothrips gowdeyi* Franklin, Proc. U. S. Nat. Mus. 33(1590):724-725, figs. 8, 15, 16, 23.
1910. *Anthothrips variabilis* D. L. Crawford, Pomona Coll. Jour. Ent. 2:166-167, fig. 69, A-E.
1912. *Haplothrips gowdeyi*, Hood, Proc. Biol. Soc. Wash. 25:62.

Additional synonymy has been given by Hood (1918-21, Mem. Queensland Mus. 6-7:121-130) and Moulton (1933, Rev. de Ent. 3(3):389, Brazil).

The writer has previously studied the types of *Ankothrips robustus* D. L. Crawford, 1909 (Bailey, 1940 Pan-Pac. Ent. 16(3):97-106) and *Thrips abdominalis* D. L. Crawford, 1910 (Bailey, 1937, Canad. Ent. 69:121-126). The synonymy of valid species has been completely reviewed in the foregoing references. Crawford himself (1941, Pomona Coll. Jour. Ent. 2:149) sank the variety *setosus* of *Frankliniella minuta*, Moulton), 1907. *Rhaptothrips peculiaris* D. L. Crawford (Pomona Coll. Jour. Ent. 1:116-119, fig. 52, A-H) was early recognized as invalid by Bagnall (1910, Ann. Ent. Soc. Belg. 54:462) since the description was

founded on a larval form (see also Hood, 1912, Proc. Biol. Soc. Wash. 25:61) *Aeolothrips vespiformis* D. L. Crawford (Pomona Coll. Jour. Ent. 1:109-110, fig. 49, A-D) was placed in *Franklinothrips* by Back (1912, Ent. News 23:73-77) and stands as the type of this distinct genus (see also Hood, 1915, Ent. News 26:162-164).

The remaining species, *Aeolothrips longiceps, Heterothrips decacornis, Anaphothrips longipennis, Dictyothrips reticulatus, Hoplandrothrips raptor, Liothrips mexicana,* and *Dicaiothrips angusticeps,* have not to the writer's knowledge been previously studied and reported upon. Through the kindness of the Dominion of Canada, Department of Agriculture at Ottawa these types have been studied, illustrated, and redescribed as deemed necessary to their clarification.

Aeolothrips kuwanaii (Moulton)

1907. *Aeolothrips kuwanaii* Moulton, U. S. D. A., Bur. Ent., Tech. Ser. 12(3):47-48, Pl. 1, figs. 5-8.
1909. *Aeolothrips longiceps* D. L. Crawford, Pomona Coll. Jour. Ent. 1:101-103, fig. 46, A-G. New synonymy.
1913. *Franklinothrips longiceps,* Bagnall. 2nd. Int. Congr. Ent. (Oxford, 1912), p. 397.
1913. *Franklinothrips longiceps,* Bagnall. Jour. Ec. Biol. 8:157-158.
1915. *Aeolothrips kuwanaii,* Hood, Ent. News 26:162.
1935. *Aeolothrips longiceps,* Bailey, Pan-Pac. Ent. 11(4):163.

The male holotype when studied with carefully controlled transmitted light exhibits the tracings of cross veins in the fore wings. It has all the characteristics of *Aeolothrips kuwanaii* and is definitely synonymous with Moulton's species.

Heterothrips decacornis D. L. Crawford

1909. *Heterothrips decacorni* D. L. Crawford, Pomona Coll. Jour. Ent. 1:110-114, fig. 50, A-I.

This species, represented on the type slide by two females, is distinct from all other species in this genus in that it has the scales on the posterior margin of the dorsum of the abdominal segments fused together (see fig. 4).

The head and pronotum (fig. 7), and the third antennal segment (fig. 5) also have been illustrated from the dorsally mounted specimen for further separation from other species. The writer has not seen *pectinifer* Hood or *mexicanus* Watson

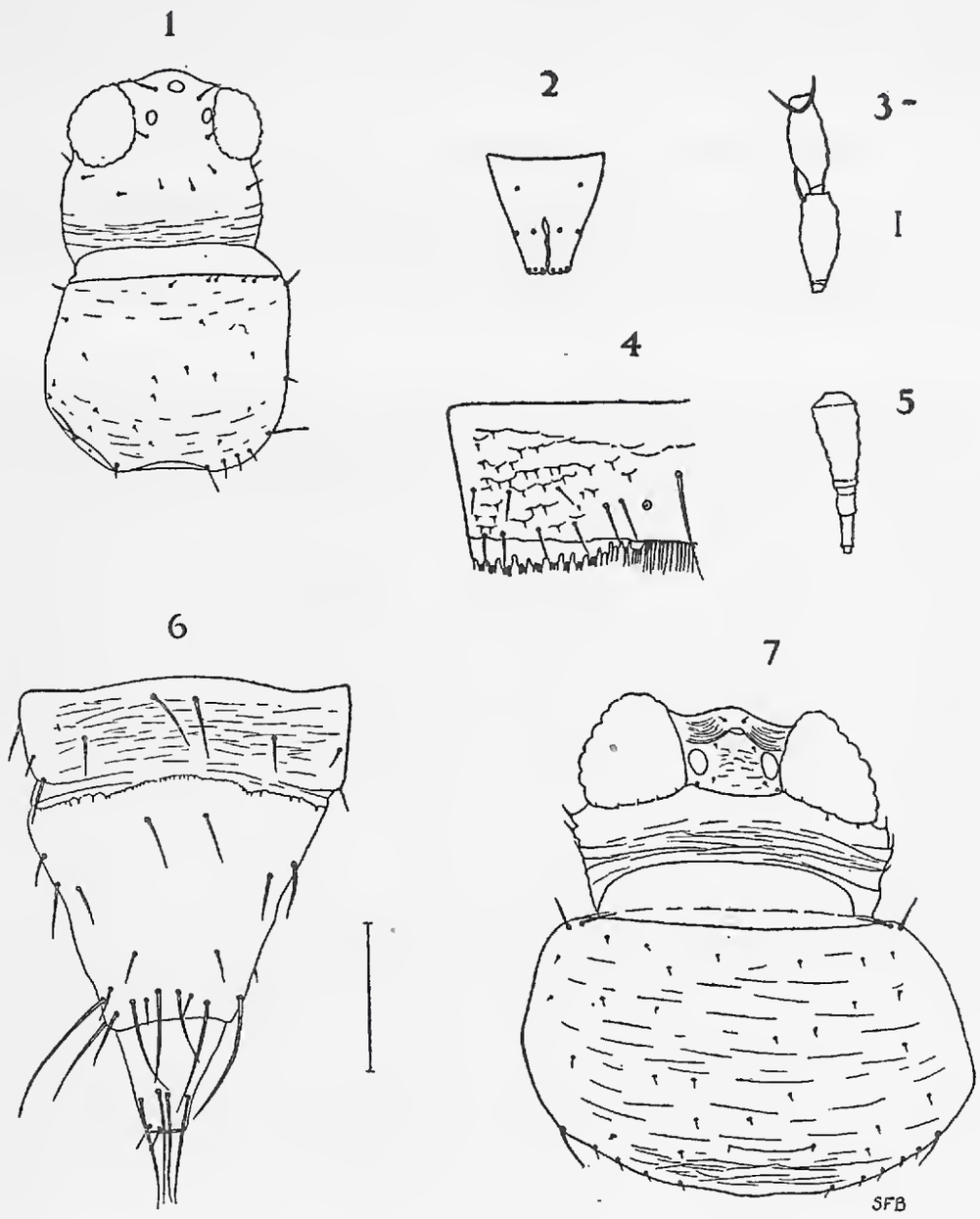

PLATE I

Fig. 1. Head and pronotum of *Anaphothrips longipennis* D. L. Crawford. 2. Dorsum of last abdominal segment of *Ctenothrips reticulatus* (D. L. Crawford). 3. Antennal segments III and IV of left antenna of *Anaphothrips longipennis*. 4. Left half of dorsum of abdominal segment VI of *Heterothrips decacornis* D. L. Crawford. 5. Antennal segment III of *H. decacornis*. 6. Terminal abdominal segments of *Anaphothrips longipennis*. 7. Head and pronotum of *H. decacornis*.

Scale: Figure 3, 0.01 mm.; figure 6, 0.1 mm. Remaining figures at same magnification as figure 6.

which are apparently the closest relatives of *decacornis* but, based on published descriptions, the very short terminal bristles on the scales of the comb separate it from *mexicanus* and *lyoniae* Hood (see also Hood, 1916, Proc. Biol. Soc. Wash. 29:110-113).

Anaphothrips longipennis D. L. Crawford

1910. *Anaphothrips longipennis* D. L. Crawford, Pomona Coll. Jour. Ent. 2:150-152, fig. 62, A-D.
1911. *Anaphothrips zeae* Moulton, U. S. D. A., Bur. Ent., Tech. Ser. 21:41, Pl. 5, figs. 31-34. New synonymy.

Two female specimens are present on Crawford's type slide; one severely treated in caustic, is mounted dorsally and the other ventrally. As is shown in figure 6 the cleared specimen shows an incomplete comb on the posterior dorsal margin of the eigthth abdominal segment. The ventrally mounted specimen has a fully developed comb as is the usual case in the species. Crawford's original description did not mention this comb nor did he illustrate it. Moulton in his review of the North American species omitted *longipennis* (although other species of Crawford are listed) and did not compare *zeae* with it. The writer has studied a long series of this common species (including macropterous males and brachypterous forms of both sexes) and notes that in some specimens the comb is very sparse and the number of bristles of the vein of the fore wing is variable (as are all the minor bristles on the head and pronotum). One female specimen has forked sense cones on the third antennal segment! Figure 1 illustrates the dorsally mounted specimen of *longipennis* as it actually appears on the type slide and figure 3 the third and fourth antennal segments. There is no doubt that the two species are synonymous when normal variation is considered.

Ctenothrips reticulatus (D. L. Crawford)

1910. *Dictyothrips reticulata* D. L. Crawford, Pomona Coll. Jour. Ent. 2:155-157, fig. 64, A-D.
1911. *Dictothrips reticulatus*, Moulton, U. S. D. A., Bur. Ent., Tech. Ser. 21:24.
1923. *Ctenothrips reticulatus*, Watson, Fla. Agr. Exp. Sta. Bull. 168:36.

This species is represented by the holotype female (which is accompanied by several specimens of *Frankliniella cephalica* on the same slide). The lack of reticulation on the last abdominal

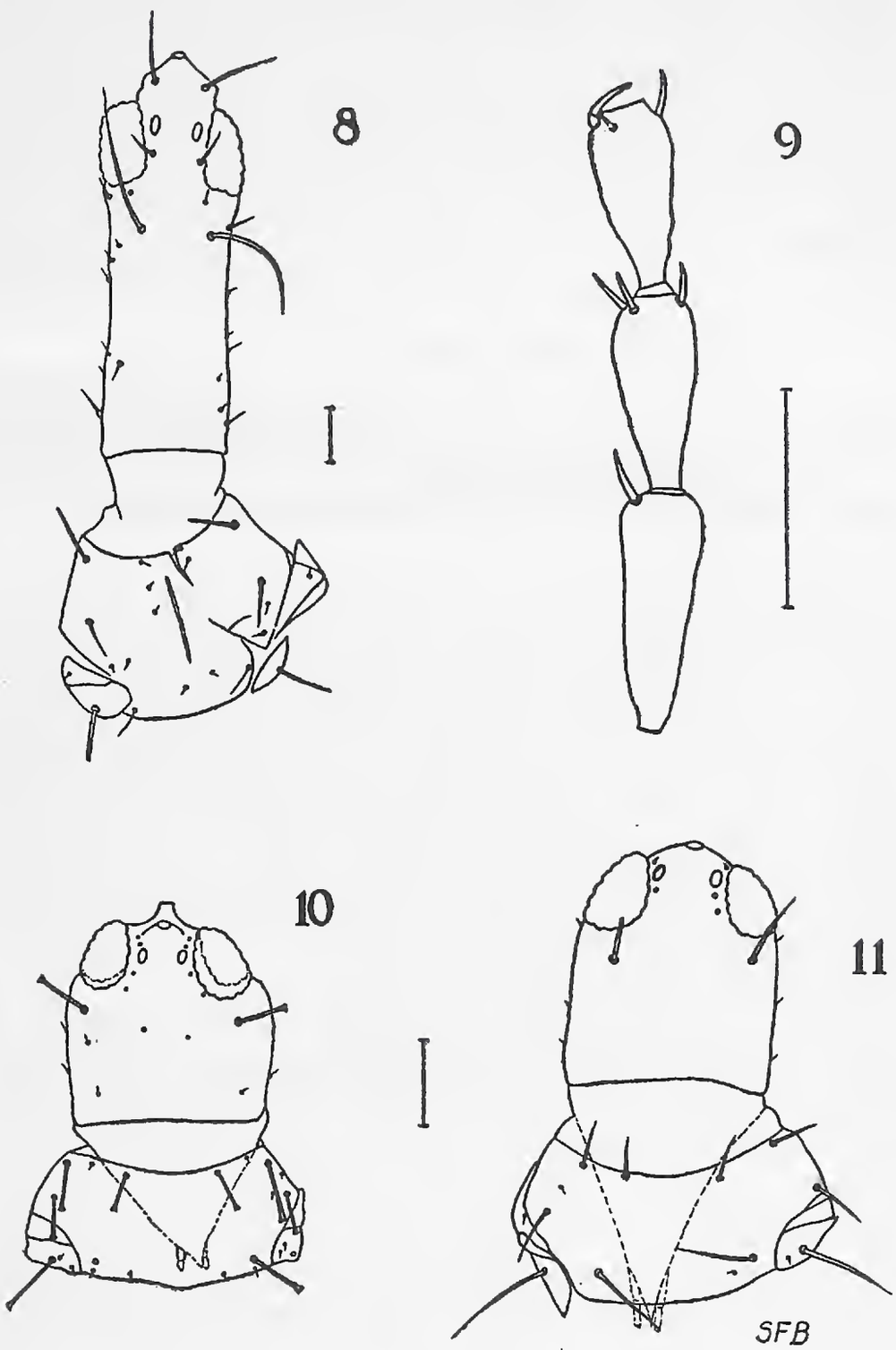

PLATE II

Fig. 8. Head and pronotum of male of *Elaphrothrips angusticeps* D. L. Crawford. 9. Antennal segments III, IV, and V of left antenna of *Liothrips mexicanus* D. L. Crawford. 10. Head and pronotum of *Hoplandrothrips raptor* D. L. Crawford. 11. Head and pronotum of *L. mexicanus*.

Scale: Length of lines at right of figures equals 0.1 mm. Figure 11 is at same magnification as figure 10.

segment (see fig. 2) separates *reticulatus* from *bridwelli* Franklin (1907, Ent. News 18:247-250). *C. reticulatus* shows affinities with both *Taeniothrips* and *Odontothrips;* the reticulations on the pronotum and particularly the dorsal ridge anterior to the ocelli, however, readily separate it from group II, D. of Taeniothrips in Steinweden's key. (1933, Trans. Amer. Ent. Soc. 59: 269-293).

HOPLANDROTHRIPS RAPTOR (D. L. CRAWFORD)

1910. *Phloeothrips raptor* D. L. Crawford, Pomona Coll. Jour. Ent. 2:159-161, fig. 66, A-E.
1915. *Hoplandrothrips raptor*, Hood, Entom. 48:102-107.

Crawford's illustration is of the head of the male of *H. raptor* and not of the female. The latter sex is illustrated in this paper (fig. 10) from the type slide which has on it one specimen of each sex, both ventrally mounted. The species in the genus *Hoplandrothrips* are most difficult to separate and Hood (1927, Entom. Amer. 7(n.s.):230) states that "for some years I have busied myself in studying the species alive in the laboratory, and in rearing them; but the results accomplished lie more in the number of slides available for study than in any definiteness of concept regarding specific limitation."

From the limited number of species of this group in the writer's collection, and the published descriptions of the others, *raptor* appears to be valid (Hood, 1941, Rev. de Ent. 12(3):556, Brazil). It seems desirable, however, to supplement the original description as follows: The eyes are prolonged much more dorsally than ventrally (see fig. 10). The number of auxiliary bristles on the posterior margin of the fore wing is nine on the female and twelve on the male. At the base of the fore wing, on the anterior margin there are three strong bristles, all dilated at the tip on the female and on the male only the inner two dilated. As in most thrips of this group, the second antennal segment is darker than the first. The sense cone formula is as follows: III, 1+2; IV, 2+; V, 1+1; VI, 1+1 (+1?). Faint reticulation can be seen in the center of the lateral margins of abdominal segments one to six. The measurement of the principal bristles on the female are (in mm.) po, 0.0561; on the pronotum aa, 0.0594, nl, 0.0561, pa, 0.0726.

LIOTHRIPS MEXICANUS D. L. CRAWFORD

1910. *Liothrips umbripennis* var. *mexicana* D. L. Crawford, Pomona Coll. Jour. Ent. 2:161.

1918–21. *Liothrips mexicanus*, Hood, Mem. Queensland Mus. 6-7: 132.

Hood raised *mexicanus* to specific rank in the above reference but did not expand its description or give any comparison with *umbripennis* or other species. Since Crawford devoted only a few lines to the original description (without illustration) it seems desirable to more fully describe and illustrate (figs. 9 and 11) *mexicanus* from the holotype female (ventrally mounted and partly cleared).

Female (macropterous). Length 2.288 mm. Color uniform dark brown. Antennal segments I and II concolorous with the body, III and basal half of IV clear yellow, remaining segments brown. All legs and tarsi brown. Wings brown in the basal half becoming gradually lighter toward the tip, marginal bristles light brown.

Head about 0.247 mm. in length and 0.221 mm. in width behind the eyes. Mouth cone long and pointed extending beyond the prosternum. Cheeks nearly straight and faintly notched at margin. Dorsum of head with fine lateral striations near the posterior. Three ocelli present and compound eyes extending posteriorly somewhat more on ventral side than on dorsum. One postocular bristle, blunt at the tip. Sense cones on antennae as follows: III, 0+1; IV, 1+2; V, 1+1 (+1).

Pronotum 0.104 mm. in length at center and 0.312 mm. in width at posterior angles; anastomosing lateral striations present on posterior. Four bristles on anterior margin, one mid-lateral, one at each posterior-lateral angle, and two somewhat forward of posterior margin. All bristles blunt at the tips. Fore femora enlarged and an appressed claw present on fore tarsus. Three strong, blunt bristles equal in length present on anterior margin of fore wing near its base. Fourteen interlocated or auxiliary bristles on posterior margin of fore wing.

Measurements (in mm.): Length of abdomen, 1.417 (including tube); length of tube, 0.195; postocular bristle, 0.079; midlateral bristles, 0.062; posterior-angular bristles, 0.112; antennal segment I, 0.049; II, 0.066; III, 0.095; IV, 0.089; V, 0.085; VI, 0.072; VII, 0.066; VIII, 0.033; total length, 0.557.

This expanded description is based on the type, slide No. 376, of the Canadian National Museum collected at Guadalajara, Mexico, by D. L. Crawford.

Because of the size of the genus *Liothrips* and the difficulty of

determining species from some of the too brief, older descriptions (often inadequately illustrated), the writer is at present unable to give any synonymy for *L. mexicanus*. Moulton's *dumosa* (also from Oak) appears closely related but this species likewise has never been clarified.

ELAPHROTHRIPS ANGUSTICEPS (D. L. CRAWFORD)

1910. *Idolothrips angusticeps* D. L. Crawford, Pomona Coll. Jour. Ent. 2:168-170, fig. 70, A-G.
1912. *Idolothrips angusticeps*, Hood, Proc. Biol. Soc. Wash. 25:62.
1923. *Dicaiothrips angusticeps*, Watson, Fla. Agr. Exp. Sta. Bull. 168:72.
1929. *Elaphrothrips angusticeps*, Moulton, Pan-Pac. Ent. 6(1):12.

This species has all the characteristics of the genus *Elaphrothrips* Andre (1940, Proc. Ent. Soc. Wash. 42(4):75-76) and is apparently distinct (based on the descriptions) from the three other Mexican species in this group: *albospinosus* Moulton and *tener* Pr. are much smaller in size; *dampfi* Hood has much shorter interocular and postocular bristles; Crawford, however, did not state upon which sex his measurements were based.

The type slide has mounted upon it two females and one male, all of which are badly broken up. The most intact specimen (male) has been illustrated in fig. 8 as it actually appears. Crawford based his description on fifteen females and seventeen males from Belize, Havana, Cuba, San Marcos and Chinandega, Nicaragua, and Guadalajara, Mexico. Not all of this material has been available for study and it is quite possible that other species are among them. A detailed study of a series of the Central American species of this group should readily establish the validity of *angusticeps*.

Of the two genera described by D. L. Crawford, *Ankothrips* is a well-established, valid genus. Of the twenty-one species and varieties described by him twelve are, as far as can be ascertained at present, valid. It is hoped that the new illustrations and expanded descriptions of those species in the more difficult genera will enable other workers to more accurately place these and other related North American forms. With the exception of the type of *Chirothrips mexicanus* (Hood, 1927, Ent. News 38: 122; 1939, Rev. de Ent. 10(2):464-466 Brazil), all of D. L. Crawford's type material is at present deposited at Ottawa, Canada.